U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

SECTION 7.7 CONTROL SYSTEMS

REVIEW RESPONSIBILITIES

Primary - Instrumentation and Control Systems Branch (ICSB)

Secondary - None

I. AREAS OF REVIEW

The areas reviewed in this section of the applicant's safety analysis report (SAR) include those control systems used for normal operation that are not relied upon to perform safety functions following anticipated operational occurrences or accidents but which control plant processes having a significant impact on plant safety. These control systems include the reactivity control systems; the reactor coolant pressure, temperature, flow, and inventory controls; and the secondary system pressure and flow controls (PWR); and the environmental control system for safety related instruments and instruments sensing lines.

These systems are reviewed to assure that they conform to the acceptance criteria and guidelines, that the controlled variables can be maintained within prescribed operating ranges, and that effects of operation or failure of these systems are bounded by the accident analyses in Chapter 15 of the SAR. The evaluation of the separation of protection systems and control systems is addressed in the reviews of Sections 7.2 and 7.3 of the SAR.

The review performed for a construction permit application may be based on preliminary designs and the depth of information need only be sufficient to provide reasonable assurance that the final design will conform to the design bases and applicable criteria with an adequate margin for safety. The review performed for an operating license (OL) application is based upon detailed design information that confirms that the final design conforms to the design bases and applicable criteria. The depth of the review for an OL application should be sufficient to conclude that the requirements of the Commission regulations have been satisfied. The depth of the review for the balance of the criteria should be sufficient to conclude that the systems conform with the guidlines to the extent necessary to support the findings of conformance to the regulations.

In addition, ICSB will coordinate with other branches that interface with the overall review of the control systems including the following:

The Reactor Systems Branch (RSB) confirms the adequacy of control systems with respect to maintaining variables within operational limits and the impact of control systems failures and actions included in the safety analysis as part of its primary review responsibility for SRP Chapters 5 and 6.

The Core Performance (CPB) confirms the adequacy of reactivity control systems to maintain the reactor power distribution within operations and the impact of control system failures and actions included in the safety analysis as part of its primary review responsibility for SRP Section 4.3.

For those areas of review identified above as being reviewed as part of the primary review responsibility of other branches, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section of the corresponding primary branch.

II. ACCEPTANCE CRITERIA

The acceptance criteria and guidelines applicable to control systems are identified in SRP Section 7.1. The review of Section 7.1 of the SAR confirms that the appropriate acceptance criteria and guidelines have been identified as applicable for these systems. The review of the control systems in this section of the SAR confirms that these systems conform to the requirements of the acceptance criteria and guidelines. The Branch Technical Positions are used when a particular design problem and an acceptable solution have been identified.

The acceptance criteria applicable for the review of control systems are:

1. General Design Criterion 13, "Instrumentation and Control."

2. General Design Criterion 19, "Control Room."

If the safety analysis precludes consideration of consequential failures of specific control system components on the basis that these components are qualified to survive the effects of accidents, additional acceptance criteria would be applicable to these components.

Regulatory Guides, Branch Technical Positions and industry standards that provide information, recommendations and guidance and in general describes a basis acceptable to the staff that may be used to implement the requirements of the Commission regulations identified above are given in SRP Section 7.1, Table 7-1 (Ref. 1) and SRP Appendix 7-A (Ref. 2). In addition, Task Action Plan items are also implemented to meet the regulations as identified in SRP Section 7.1, Table 7-2 (Ref. 3).

III. REVIEW PROCEDURES

This subsection describes the general procedures to be followed in reviewing control systems. The bases for the evaluation of conformance to the requirements of the acceptance criteria and guidelines may be based upon referenced

approved designs. The category of referenced approved designs include topical reports, standard design approvals, and designs of systems which have been previously reviewed and approved by the Staff. If any aspect of a design is not identical to that which is referenced, an evaluation must be made to address the adequacy of the differences and the conclusions included in the safety evaluation report.

Review guidance for conformance to the GDC are provided in Appendix A of SRP Section 7.1 (Reference 4). The review procedures are as follows:

1. The review should confirm that the control systems satisfy the requirements of the acceptance criteria and the system design bases.

2. The review should confirm that the plant accident analysis in Chapter 15 of the SAR does not rely on the operability control systems to assure safety.

3. The review should confirm that the safety analysis includes consideration of the effects of both control systems action and inaction in assessing the transient response of the plant for accidents and anticipated operational occurrences.

4. The review should confirm that the consequential effects of anticipated operational occurrences and accidents do not lead to control systems failures which would result in consequences more severe than those bounded by the analysis in Chapter 15 of the SAR.

5. The review should confirm that the failure of any control system component or any auxiliary supporting system for control systems do not cause plant conditions more severe than those bounded by the analysis of anticipated operational occurrences in Chapter 15 of the SAR. (The evaluation of multiple independent failures is not intended.)

6. The review should confirm that the environmental control system has been designed to meet the guidelines of RG 1.151, position 5 so that adequate protection from extreme cold weather has been provided.

In certain instances, it will be the reviewer's judgment that for a specific case under review, emphasis should be placed on specific aspects of the design, while other aspects of the design need not receive the same emphasis and indepth review. Typical reasons for such a nonuniform placement of emphasis are the introduction of new design features or the utilization in the design of design features previously reviewed and found acceptable. However, in all cases, the review must be sufficient to conclude conformance to the acceptance criteria, i.e., the requirements of the Commission's regulations.

IV. EVALUATION FINDINGS

The reviewer confirms that sufficient information has been provided and the review supports conclusions of the following type, to be included in the Staff's safety evaluation report:

> The control systems used for normal operation, that are not relied upon to perform safety functions but which control plant processes having a significant impact on plant safety, have been reviewed. These control systems include the reactivity control systems and

the control systems for the primary and secondary coolant (PWR) systems. Also, the environmental control system which protects safety related instruments and instrument sensing lines from the effects of freezing due to extreme cold weather has been reviewed.

The staff concludes that the control systems are acceptable and meet the relevant requirements of General Design Criteria 13 and 19. This conclusion is based on the following:

Based on our review of the plant transient response to normal load changes and anticipated operational occurrences such as reactor trip, turbine trip, upsets in the feedwater and steam bypass steams, we conclude that the control systems are capable of maintaining system variables within prescribed operating limits. The applicant has also provided an environmental control system to protect safety related instruments and instruments sensing lines from freezing. This system meets the guidelines of RG 1.151, position 5. Therefore, we find that the control systems satisfy this aspect of GDC 13.

Our review of control systems included features of these systems for both manual and automatic control of the process systems. We conclude that the features for manual and automatic control facilitate the capability to maintain plant variables within prescribed operating limits. We find that the control systems permit actions which can be taken to operate the plant safely during normal operation, including anticipated operational occurrences, and therefore the control systems satisfy GDC 19, "Control Room" with regards to normal plant operations.

The conclusions of the analysis of anticipated operational occurrences and accidents as presented in Chapter 15 of the SAR have been used to confirm that plant safety is not dependent upon the response of the control systems. We have confirmed that failure of the systems of themselves or as a consequence of supporting systems failures, such as power sources, do not result in plant conditions more severe than those bounded by the analysis of anticipated operational occurrences.

Finally, we have confirmed that the consequential effects of anticipated operational occurrences and accidents do not result in control systems failures that would cause plant conditions more severe than those bounded by the analysis of the events and we find that the control systems are not relied upon to assure plant safety. The applicant has also incorporated into the systems design the recommendations of Task Action Plan items [identify item number and how implemented] which we have reviewed and found acceptable.

The conclusions noted above for the control systems are applicable to all portions of the systems except for the following for which acceptance is based upon prior Commission review and approval as noted: [List applicable system or topics and identify references]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides and NUREGs.

VI. REFERENCES

1. Standard Review Plan Section 7.1, Table 7-1, "Acceptance Criteria and Guidelines for Instrumentation and Control Systems Important to Safety."

2. Standard Review Plan Appendix 7-A, "Branch Technical Positions (ICSB)."

3. Standard Review Plan Section 7.1, Table 7-2, "TMI Action Plan Requirements for Instrumentation and Control Systems Important to Safety."

4. Standard Review Plan Section 7.1, Appendix A, "Acceptance Criteria and Guidelines for Instrumentation and Control Systems Important to Safety."